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Challenges and solutions

NORDLIGE VERDENER

Northern Worlds – Report from workshop 2 at the National Museum, 1 November 2011

Edited by Hans Christian Gulløv, Peter Andreas Toft and Caroline Polke Hansgaard

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Rødøy in Flatøysund, Alstahaug area,
Helgeland, South Nordland
Photo: Flemming Kaul

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Copenhagen 2012

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Close-up of a string of beads on an amaut, a woman's jacket, combining large worn 18th-century glass beads with unworn seed beads produced in the 19th century. Photo: Peter Andreas Toft.

Pinhoulland seen from the north west down towards Voe of Browland. Photo: D. Mahler.

Pioneering farmers cultivating new lands in the North

The expansion of agrarian societies during the Neolithic and Bronze Age in Scandinavia

Lasse Sørensen
Danish Prehistory

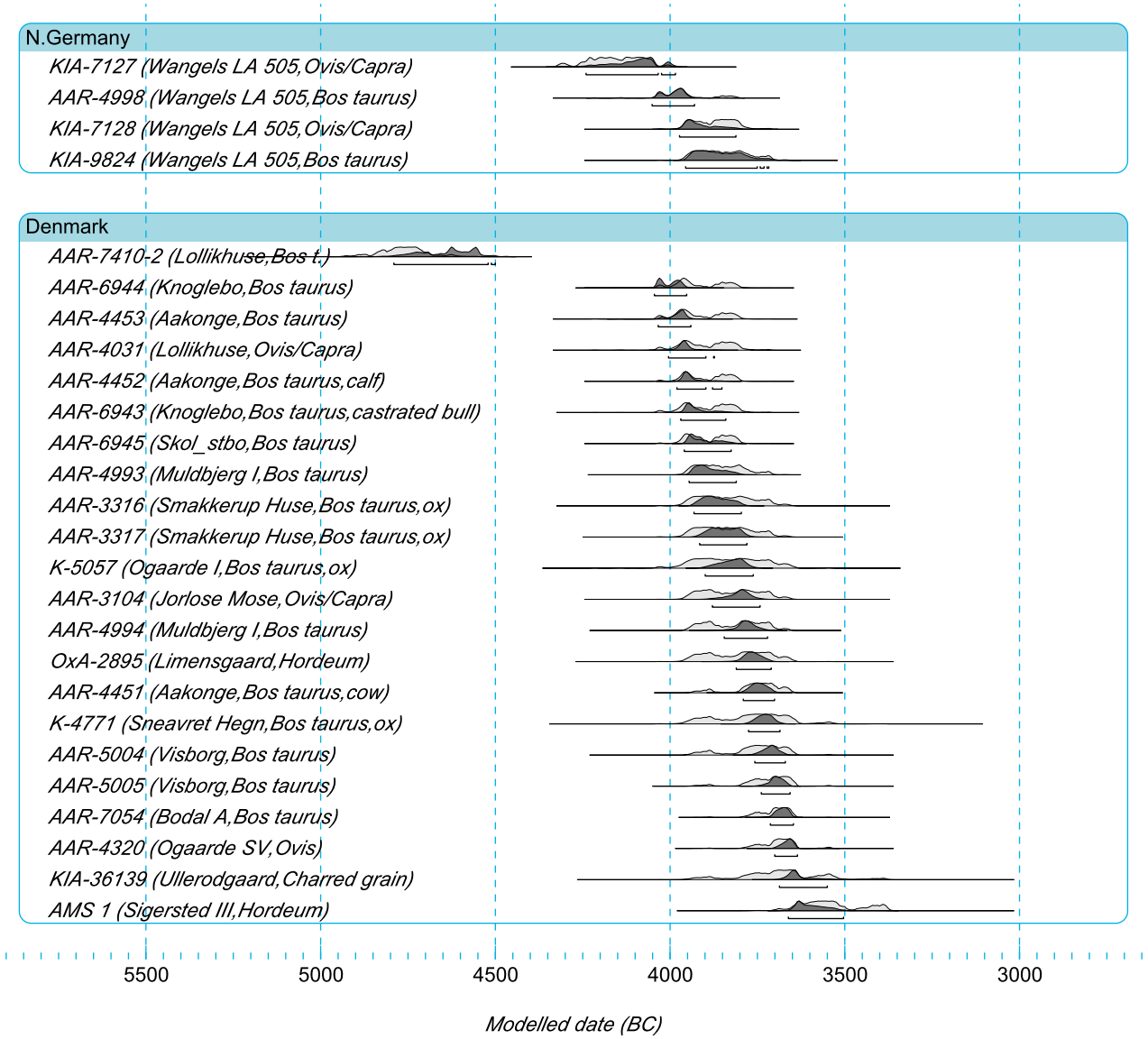
Expansions of agrarian societies during the Neolithic and the Bronze Age in Scandinavia can be studied in a long-term perspective lasting from 4000 to 500 BC. Through a series of ^{14}C datings of primary evidence of agriculture it is possible to document the speed of the agrarian advance with its shifts between expansion, stagnation and decline through the Neolithic and the Bronze Age. The reasons for these shifts are discussed, and it is concluded that diversified climatic zones together with environmental and ideological factors play a central role in the understanding of the expansion of agrarian societies. In geographical terms the length of the Scandinavian Peninsula is equivalent to the distance from Denmark to the southern parts of Italy. The expansion in southern Scandinavia (Denmark and southern Sweden) during the Early Neolithic was rapid, lasting a few centuries (4000-3700 BC), followed by a consolidation of the agrarian way of life. The southeastern part of Norway may be a part of this Early Neolithic (4000-3500 BC) advance. The next advance, to the central parts of Scandinavia, is observed in the western part of Norway during the Middle Neolithic (2800-2400 BC), and the Late Neolithic (2400-1800 BC). The last advance towards northern Scandinavia and beyond the Arctic Circle is observable in the Middle and Late Bronze Age (1400-500 BC). The transition towards an agrarian way of life was probably different from region to region and occurred in a complex and continuous process of migration with gradual assimilation of pioneering farmers and local hunter-gatherers.

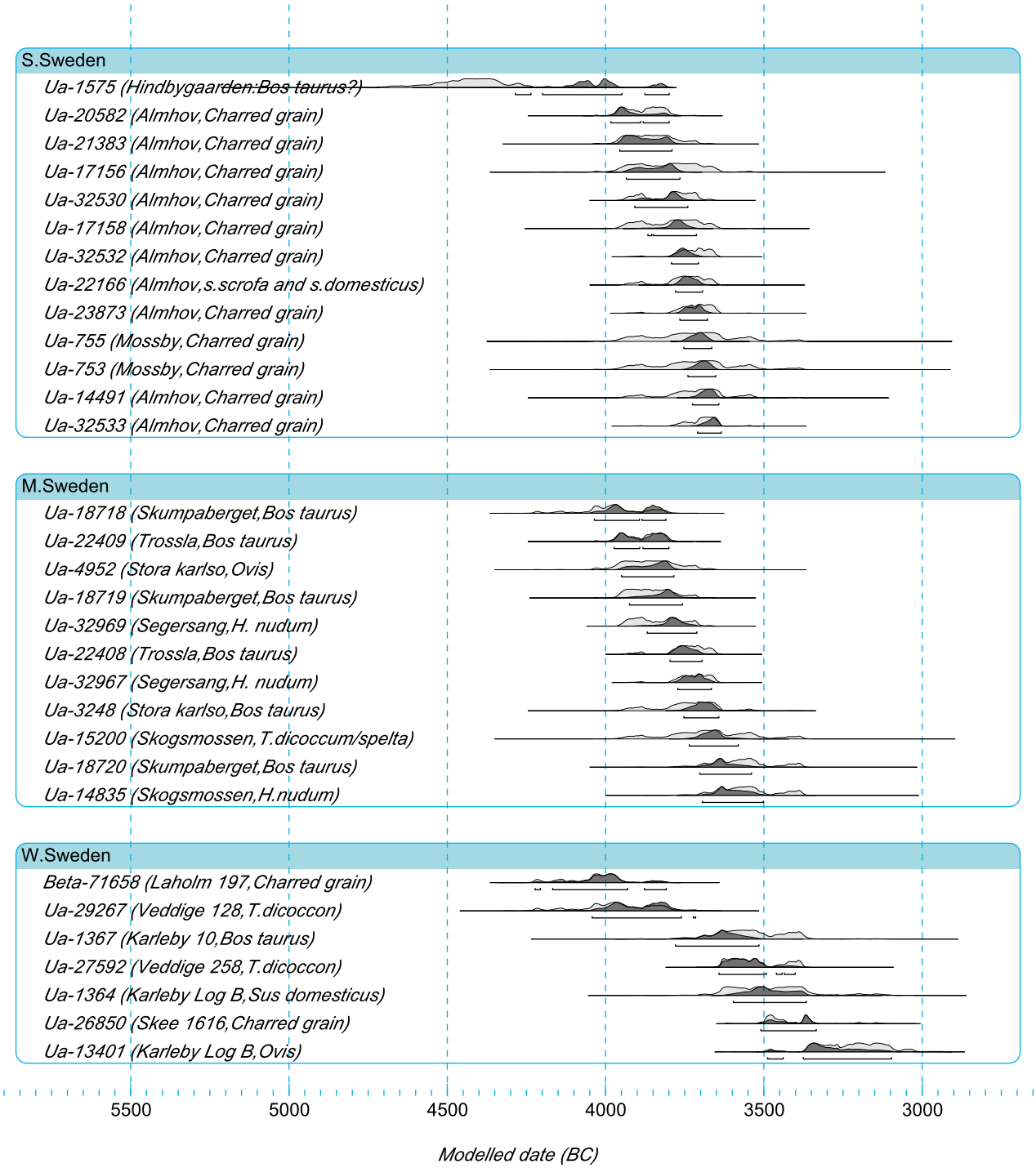
Introduction

The object of this paper is to investigate the speed of the expansion of agrarian societies in Scandinavia (Denmark, Sweden and Norway) in a long-term per-

Fig. 1. ^{14}C dates showing the expansion of agrarian societies during the Early Neolithic.

All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.




S.Sweden
Ua-1575 (Hindbygaarden:Bos taurus?)
Ua-20582 (Almhov,Charred grain)
Ua-21383 (Almhov,Charred grain)
Ua-17156 (Almhov,Charred grain)
Ua-32530 (Almhov,Charred grain)
Ua-17158 (Almhov,Charred grain)
Ua-32532 (Almhov,Charred grain)
Ua-22166 (Almhov,s.scrofa and s.domesticus)
Ua-23873 (Almhov,Charred grain)
Ua-755 (Mossby,Charred grain)
Ua-753 (Mossby,Charred grain)
Ua-14491 (Almhov,Charred grain)
Ua-32533 (Almhov,Charred grain)
M.Sweden
Ua-18718 (Skumpaberget,Bos taurus)
Ua-22409 (Trossla,Bos taurus)
Ua-4952 (Stora karlso,Ovis)
Ua-18719 (Skumpaberget,Bos taurus)
Ua-32969 (Segersang,H. nudum)
Ua-22408 (Trossla,Bos taurus)
Ua-32967 (Segersang,H. nudum)
Ua-3248 (Stora karlso,Bos taurus)
Ua-15200 (Skogsmossen,T.dicoccum/spelta)
Ua-18720 (Skumpaberget,Bos taurus)
Ua-14835 (Skogsmossen,H.nudum)
W.Sweden
Beta-71658 (Laholm 197,Charred grain)
Ua-29267 (Veddige 128,T.dicoccon)
Ua-1367 (Karleby 10,Bos taurus)
Ua-27592 (Veddige 258,T.dicoccon)
Ua-1364 (Karleby Log B,Sus domesticus)
Ua-26850 (Skee 1616,Charred grain)
Ua-13401 (Karleby Log B,Ovis)
5500
5000
4500
4000
3500
3000
Modelled date (BC)

spective from 4000 to 500 BC (note 1). Such an investigation could modulate the hitherto entrenched positions in the discussion of whether agriculture was introduced by migrating agrarian societies or by local populations into a combination of the two hypotheses. But first it is necessary to explain what distinguishes a farmer from a hunter-gatherer. Hunting, fishing and gathering could be practised anywhere these activities were possible, independently of whether you were a hunter-gatherer or a farmer. What distinguishes farmers from hunter-gatherers in a Neolithic or Bronze Age context is cultivation and husbandry all year round. In the first place, cultivation requires a whole new set of technologies, including slash-and-burn activities for clearing the landscape, the preparation of fields, the sowing and growing of crops, the processing of grain and the storage of seeds. Secondly, keeping domesticated animals all year round requires storage of food for the winter. I therefore see no problem with the fact that Late Mesolithic or Neolithic hunter-gatherers could have kept a few domesticated animals for meat reserves. This does not make them farmers. Let us now take a look at the primary evidence of agriculture that documents the advance of agrarian societies in Scandinavia.

Cereal grains

Direct ^{14}C datings of charred cereal grains of Emmer *(Triticum dicoccoides)*, Einkorn *(Triticum monococcum)* and Naked barley *(Hordeum vulgare convar nudum)* have been established for Early Neolithic sites in southern Scandinavia. These are from the period 4000-3800 BC, which is contemporary with the period in which pollen samples from the same area show a higher degree of *Plantago lanceolata*. This could indicate clearances of the forest with the slash-and-burn method (Andersen 1993: 161ff; Odgaard 1994: 1ff; Rasmussen 2005: 1116ff; Sjögren 2006) (figs. 1 & 2). At the same time a few grain impressions have been identified in some Late Ertebølle potsherds from the coastal sites Löddesborg and Vik in Scania (Jennbert 1984). However, both sites have intermixed layers with Late Ertebølle and Early Funnel Beaker ceramics. Thus we cannot preclude the possibility that these sherds could originate from funnel beakers, since they have the same coarse tempering and thickness as the Ertebølle ceramics (Koch 1987: 107ff). Currently, there is no other archaeological evidence supporting any kind of cultivation during the Late Mesolithic in southern Scandinavia.

There are still no direct ^{14}C datings of cereal grains from the southeastern part of Norway (Østfold and Vestfold), but the region is probably connected with the Early Neolithic agrarian expansion, because cereal pollen from Napperød-

C-14 dates showing the expansion of Early Neolithic agrarian societies

Region	Site	Material	Lab. Nr.	BP	±	References
Northern Germany	Wangels LA 505	Ovis/Capra	KIA-7127	5325	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Bos taurus	AAR-4998	5165	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Ovis/Capra	KIA-7128	5085	45	Hartz & Lübke 2005, 119ff
Northern Germany	Wangels LA 505	Bos taurus	KIA-9824	5047	53	Hartz & Lübke 2005, 119ff
Denmark, Zealand	Lollikhuse	Bos taurus	AAR-7410-2	5890	55	Sørensen 2005, 304f
Denmark, Zealand	Knoglebo	Bos taurus	AAR-6944	5135	45	Heinemeier 2002, 273f
Denmark, Zealand	Åkonge	Bos taurus	AAR-4453	5135	50	Heinemeier & Rud 1999, 340
Denmark, Zealand	Lollikhuse	Ovis/Capra	AAR-4031	5120	55	Heinemeier & Rud 1999, 340
Denmark, Zealand	Åkonge	Bos taurus, calf	AAR-4452	5120	40	Heinemeier & Rud 1999, 340
Denmark, Zealand	Knoglebo	Castrated bull?	AAR-6943	5115	50	Heinemeier 2002, 273f
Denmark, Zealand	Skolæstbo	Bos taurus	AAR-6945	5110	40	Heinemeier 2002, 273f
Denmark, Zealand	Muldbjerg I	Bos taurus	AAR-4993	5050	45	Heinemeier & Rud 2000, 302
Denmark, Zealand	Smakkerup Huse	Bos taurus, ox	AAR-3316	5040	65	Price & Gebauer 2006, 123
Denmark, Zealand	Smakkerup Huse	Bos taurus, ox	AAR-3317	5040	60	Price & Gebauer 2006, 123
Denmark, Zealand	Øgårde I	Bos taurus, ox	K-5057	5030	90	Koch 1998, 253
Denmark, Zealand	Jorløse Mose	Ovis/Capra	AAR-3104	5020	60	Heinemeier & Rud 1998, 303
Denmark, Zealand	Muldbjerg I	Bos taurus	AAR-4994	5010	50	Heinemeier & Rud 2000, 302
Denmark, Bornholm	Limensgård	Hordeum	OxA-2895	5000	70	Fischer 2002
Denmark, Zealand	Åkonge	Bos taurus, cow	AAR-4451	4965	45	Heinemeier & Rud 1999, 340
Denmark, Zealand	Snævret Hegn	Bos taurus, ox	K-4771	4960	90	Koch 1998, 252
Denmark, Jutland	Visborg	Bos taurus	AAR-5004	4955	60	Heinemeier & Rud 2000, 302
Denmark, Jutland	Visborg	Bos taurus	AAR-5005	4925	55	Heinemeier & Rud 2000, 302
Denmark, Zealand	Bodal A	Bos taurus	AAR-7054	4920	40	Heinemeier 2002, 273f
Denmark, Zealand	Øgårde SV	Ovis	AAR-4320	4900	50	Heinemeier & Rud 1999, 340
Denmark, Zealand	Ullerødgård	Cereal from pit A493	KIA-36139	4890	90	Esben Aasleff personal comment
Denmark, Zealand	Sigersted III	Hordeum	AMS 1	4780	70	Koch 1998
Sweden, Scania	Hindbygården	Bos taurus?	Ua-1575	5570	110	Hadevik 2009
Sweden, Scania	Almhov	Charred cereal (a23455)	Ua-20582	5095	45	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal (A190499)	Ua-21383	5065	60	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A6b	Ua-17156	5000	95	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A1942	Ua-32530	5000	40	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, A61	Ua-17158	4990	70	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, K24 (A32422)	Ua-32532	4940	40	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	s. scrofa and s. domesticus	Ua-22166	4960	50	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal, P04 (A32422)	Ua-23873	4930	45	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Mossby	Charred cereal	Ua-755	4925	115	Larsson 1992, 74
Sweden, Scania	Mossby	Charred cereal	Ua-753	4915	110	Larsson 1992, 74
Sweden, Scania	Almhov	Charred cereal, A2778	Ua-14491	4910	80	Nilsson &Rudebeck 2010, 112ff
Sweden, Scania	Almhov	Charred cereal (A35862)	Ua-32533	4910	45	Nilsson &Rudebeck 2010, 112ff
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18718	5170	65	Hallgren 2008
Middle Sweden, Södermanland	Trössla	Bos taurus	Ua-22409	5105	45	Hallgren 2008
Middle Sweden, Gotland	Stora karlsö	Ovis	Ua-4952	5070	75	Lindqvist & Possnert 1997
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18719	5055	50	Hallgren 2008
Middle Sweden, Södermanland	Segersäng	H. nudum	Ua-32969	5025	45	Hallgren 2008
Middle Sweden, Södermanland	Trössla	Bos taurus	Ua-22408	4955	45	Hallgren 2008
Middle Sweden, Södermanland	Segersäng	H. nudum	Ua-32967	4940	40	Hallgren 2008
Middle Sweden, Gotland	Stora karlsö	Bos taurus	Ua-3248	4935	75	Lindqvist & Possnert 1997
Middle Sweden, Västmanland	Skogsmossen	T. dicoccum/spelta	Ua-15200	4880	110	Hallgren 2008
Middle Sweden, Närke	Skumpaberget	Bos taurus	Ua-18720	4810	75	Hallgren 2008
Middle Sweden, Västmanland	Skogsmossen	H. nudum	Ua-14835	4795	75	Hallgren 2008
Western Sweden, Halland	Laholm 197	Charred cereal	Beta-71658	5200	60	Svensson 2010
Western Sweden, Halland	Veddige 128	T. dicoccon	Ua-29267	5160	78	Johansson et al. 2011
Western Sweden, Västergötland	Karleby 10	Bos taurus	Ua-1367	4775	95	Persson 1999
Western Sweden, Halland	Veddige 258	T. dicoccon	Ua-27592	4750	50	Ryberg 2006
Western Sweden, Västergötland	Karleby Log B	Sus domesticus	Ua-1364	4710	100	Persson 1999
Western Sweden, Bohuslän	Skee 1616	Charred cereal	Ua-26850	4615	40	Westergaard 2008
Western Sweden, Västergötland	Karleby Log B	Ovis	Ua-13401	4530	60	Karl Göran Sjögren personal com.

Fig. 2. Table of the different Early Neolithic sites in Southern Scandinavia where primary agrarian evidence has been ^{14}C-dated.

tjern (5460±230 BP; 4827-3785 cal BC), Haraldstadmyr (5010±100 BP; 4037-3637 cal BC) and Haraldsvann (5010±70 BP; 3956-3661 cal BC) has been dated to this period (Henningsmoen 1980; Østmo 1988; Prøsch-Danielsen 1996: 85ff; Glørstad 2010: 275). Directly dated cereal grains are also missing for western Norway (Hordaland), although a wide range of sites from the Middle Neolithic (2800-2400 BC) have produced charcoal layers that have been interpreted as representing cultivation with the slash-and-burn method (Olsen 2009: 589ff) (figs. 11 & 12). Furthermore, cereals were present in pollen analyses ^{14}C-dated to the Middle Neolithic in western Norway (Hordaland), which document cultivation activities during this period (Hjelle et al. 2006: 147ff). In the central part of Sweden (Västernordland) direct ^{14}C datings of charred cereal grains from the Late Neolithic have been reported from Bjästemon and Lill-Mosjön, whereas we have no direct ^{14}C dates from central Norway (Trøndelag). However, a piece of charcoal from the site Egge in Trøndelag was ^{14}C-dated to the Early Bronze Age (3385±70 BP; 1745-1520 cal. BC) (TUa-3645); this came from a ploughmark that contained a grain of barley (Solem 2002: 6ff). A grain kernel from Stiurhelleren farther north in Nordland produced a slightly later ^{14}C dating to the Middle and Late Bronze Age. Pollen of cereals from Bakkan, also in Nordland, indicates when agriculture expanded to the vicinity of the Arctic Circle and beyond (Johansen & Vorren 1986: 740; Johansen 1990: 5). In northern Norway (Troms) a grain of barley from Kveøya was ^{14}C-dated to (3936±30 BP; 2564-2307 cal BC) (Wk-26504). Currently this is the only grain documenting agrarian activities this far north during the Late Neolithic. It must be treated with caution, because most ^{14}C datings place the cultivation of wheat and barley within the middle and later parts of the Bronze Age (Arntzen & Sommerseth 2010).

Domesticated animals

Domesticated cattle *(Bos taurus)* are observed throughout southern Scandinavia around 4000-3700 BC (figs. 1 & 2). Recently, what were presumed to be domesticated cows from Rosenhof LA 58 and 83 were dated to 4700 BC. But after a DNA analysis, they turned out to be small aurochses (Hartz & Lübke 2005; Noe-Nygaard et al. 2005). An early cow tooth from Lollikhuse was dated to (5890±55 BP; 4929-4612 cal BC) (AAR-7410-2). This is in fact probably an exotic pendant demonstrating direct or indirect contacts with farming societies in central Europe (Sørensen 2005: 305). Cow bones from Smakkerup Huse have also been used to argue that Ertebølle hunters had access to domesticated animals (Price & Gebauer 2006). These

bones were dated to (5059±68 BP; 3981-3701 cal BC) (AAR-3316) and (5060±61 BP; 3968-3711 cal BC) (AAR-3317) and were found in stratified Late Atlantic refuse layers. Unfortunately the actual site was eroded by transgressions and regressions in the Subboreal period, and we cannot rule out the possibility that these bones belong to an Early Funnel Beaker occupation. Sheep and goat *(Ovis/Capra)* also appear in southern Scandinavia during the period 4000 to 3800 BC and a few centuries later in western Sweden. Domesticated pigs *(Sus domesticus)* and wild boars *(Sus scrofa)*, found together in a pit at the Early Neolithic site Almhov in Scania, have been dated to (4960±50 BP; 3937-3645 cal BC) (Ua-22166) (Nilsson & Rudebeck 2010: 112ff). However, the identification of domesticated pigs has proven difficult, based as it often is on the criterion that they were smaller than wild boars and had a different length and anterior breadth of the third molar (Brinch Petersen & Egeberg 2009: 562). Future DNA analysis could resolve this issue. Currently there is no certain archaeological evidence of entire domesticated animals (except the dog) earlier than 4000 BC in southern Scandinavia. A summary of the early datings of cereal grains and domesticated animals in southern Scandinavia clearly demonstrates that we are dealing with a process of rapid expansion.

We lack direct ^{14}C datings of domesticated animals from the Early Neolithic in the southeastern part of Norway. From the western part of Norway (Hordaland) datings of *Bos taurus* and *Ovis/Capra* from Skipshelleren and faeces from *Ovis* from the site Budalen belong to the middle and later part of the third millennium BC. The same result emerged from a ^{14}C dating of a cattle tooth from the kitchen midden at Hammersvolden in Trøndelag in the central part of Norway. Farther north near the Arctic Circle (Nordland) an *Ovis* tooth has been ^{14}C-dated to the Early Bronze Age on Stiurhelleren (Johansen 1990: 5). A slightly later ^{14}C dating to the Late Bronze Age of a *Bos taurus* has been reported from Storbåthallaran (Nordland), which is located north of the Arctic Circle (Johansen & Vorren 1986: 742). Investigating the direct ^{14}C datings of cereal grains and domesticated animals has enabled us to follow the agrarian expansion towards northern Scandinavia (figs. 11, 12 & 13).

Cultivation and crop processing

Indirect evidence of cultivation has been reported in the form of cereal crop processing and threshing waste from Emmer *(Triticum dicoccoides)* used as chaff tempering in clay discs, which has been found in some pits from the Early Neolithic site at Lisbjerg Skole near Århus (Skousen 2008: 124). ^{14}C analysis of hazelnut shells from the pits (A-2087,

A-2092 and A2165) dates the material to (5190±90 BP; 4251-3785 cal BC) (AAR-8542) and to (4975±55 BP; 3942-3651 cal BC) (AAR-9225). Straw or chaff tempering is also found in clay discs from the Early Neolithic site Store Valby (Becker 1954: 134ff; Helbæk 1954: 198ff; Nielsen 1984: 119). Other evidence of crop processing can be revealed by the existence of quern stones. These have been reported from Early Neolithic sites in Denmark and Sweden (Erantisvej and Kallmossen), which both contain short-necked funnel beakers (Staal 2005; Hallgren 2008: 211). Moreover, wear on sickles from Early Neolithic sites also document harvesting activities (Juel Jensen 1994). The ^{14}C dates of the pits at Lisbjerg Skole are very important, because they document cultivation and crop processing which could be earlier than the *Ulmus-fall* (Andersen & Rasmussen 1993: 125ff). Currently our knowledge of cereal crop processing from Neolithic contexts in Scandinavia is still rather limited, but offers huge potential, whereas cultivation using slash-and-burn methods is better documented.

The earliest plough-marks from southern Scandinavia were found beneath a long barrow at Højensvej 7 near Egense on Funen. They covered an area of 85 square metres, thus illustrating intensive cultivation (Beck 2009: 7ff, in prep.). Some of the plough-marks were cut by a pit which was dated by a hazelnut shell to (4900±40 BP; 3770-3637 cal BC) (POZ-28068). Other plough-marks with more limited extensions have been identified beneath a few long barrows in Jutland and Funen (Jørgensen 1977: 7ff; Fischer 1980: 23ff; Ebbesen 1992: 96). We can conclude that the larger fields were cultivated using the ard to get the maximum yield from the soil as early as the beginning of the Early Neolithic.

From the southeastern part of Norway (Østfold and Vestfold) there are no plough-marks, although some could be concealed underneath some of the few megaliths from this region. Clear evidence of cultivation using the slash-and-burn method has been reported from western Norway (Hordaland) (Olsen 2009: 592ff). ^{14}C datings of the charcoal layers from several sites in this region range from the Middle to the Late Neolithic, making them contemporary with the evidence of domesticated animals and pollen analysis in western Norway. In the central parts of Norway (Trøndelag) and Sweden (Västernordland) evidence of cultivation is rather sparse (Asprem 2012; Gustafsson & Spång 2007). However, farther north beyond the Arctic Circle plough-marks from Moland (Nordland) have been dated by charcoal found in one of the tracks to the Late Bronze Age and Pre-Roman Iron Age (Johansen & Vorren 1986: 742). A simi-

lar ^{14}C result emerged from a ploughmark from Skålbunes in Troms, which is also located beyond the Arctic Circle (2273±35 BP; 400-209 cal BC) (Wk-20626) (Arntzen 2012). The meagre evidence of cultivation shows more or less the same tendencies in the rate of agrarian advance in Scandinavia (Figs. 11 & 12). Let us go through the secondary evidence from these agrarian societies.

The secondary evidence

A different material culture, found in southern Scandinavia at the beginning of the fourth millennium BC, points towards migrations of farmers from central Europe expanding into southern Scandinavia. It consists of point-butted axes (Nielsen 1977: 65ff), jade axes (Klassen 2004), battle axes (Zápotocký 1992; Ebbesen 1998: 77ff), short-necked funnel beakers (Koch 1998), clay discs (Davidsen 1973: 5ff) and copper (Klassen 2000). The structures include two-aisled houses (Nielsen 1997: 9ff), flint mines (Becker 1980: 456ff; Olausson et al. 1980: 183), long barrows (Rudebeck 2002: 119ff) and later Sarup enclosures (Andersen 1997) and long dolmens (Ebbesen 2011).

In the southeastern part of Norway material culture in the form of funnel beaker ceramics (Østmo 2007), thin-butted axes (Hinsch 1955), polygonal battle axes (Mikkelsen 1984) and megaliths (Østmo 1988) can be associated with the Funnel Beaker Culture. In the western part of Norway the agrarian expansion during the Middle Neolithic is associated with the sudden appearance of material culture containing thick-butted axes, battle axes and structures (two-aisled houses) all belonging to the Battle Axe Culture (2800-2400 BC) (Olsen 2009: 590ff). In the central parts of Norway artefacts like battle axes (Asprem 2012) and flint daggers (Hagen 1983; Apel 2001: 282) of type 1 can be connected to the agrarian expansion (Lomborg 1973) (fig. 10). In northern parts of Norway bronze artefacts from the Middle and Late Bronze Age together with rock carvings of ships have a southern Scandinavian origin which may be connected with the latest expansion beyond the Arctic Circle (Arntzen & Sommerseth 2010: 122ff; Rønne 2011: 58ff; Kaul 2011: 44ff). Furthermore a 12 m long three-aisled house found on Kveøya in Troms, dated to (2642±30 BP; 892-781 cal BC) (Wk-24533) may also have been connected with this advance (Arntzen & Sommerseth 2010; Arntzen 2012).

Axes in southern Scandinavia

The distribution of the Early Neolithic battle axes is significant, because they illustrate dense concentrations in central Europe, thus indicating an origin of these pioneering farmers within the Michelsberg and Baalberg cultures (Lüning 1968) (fig. 3). The earliest types of battle axes,

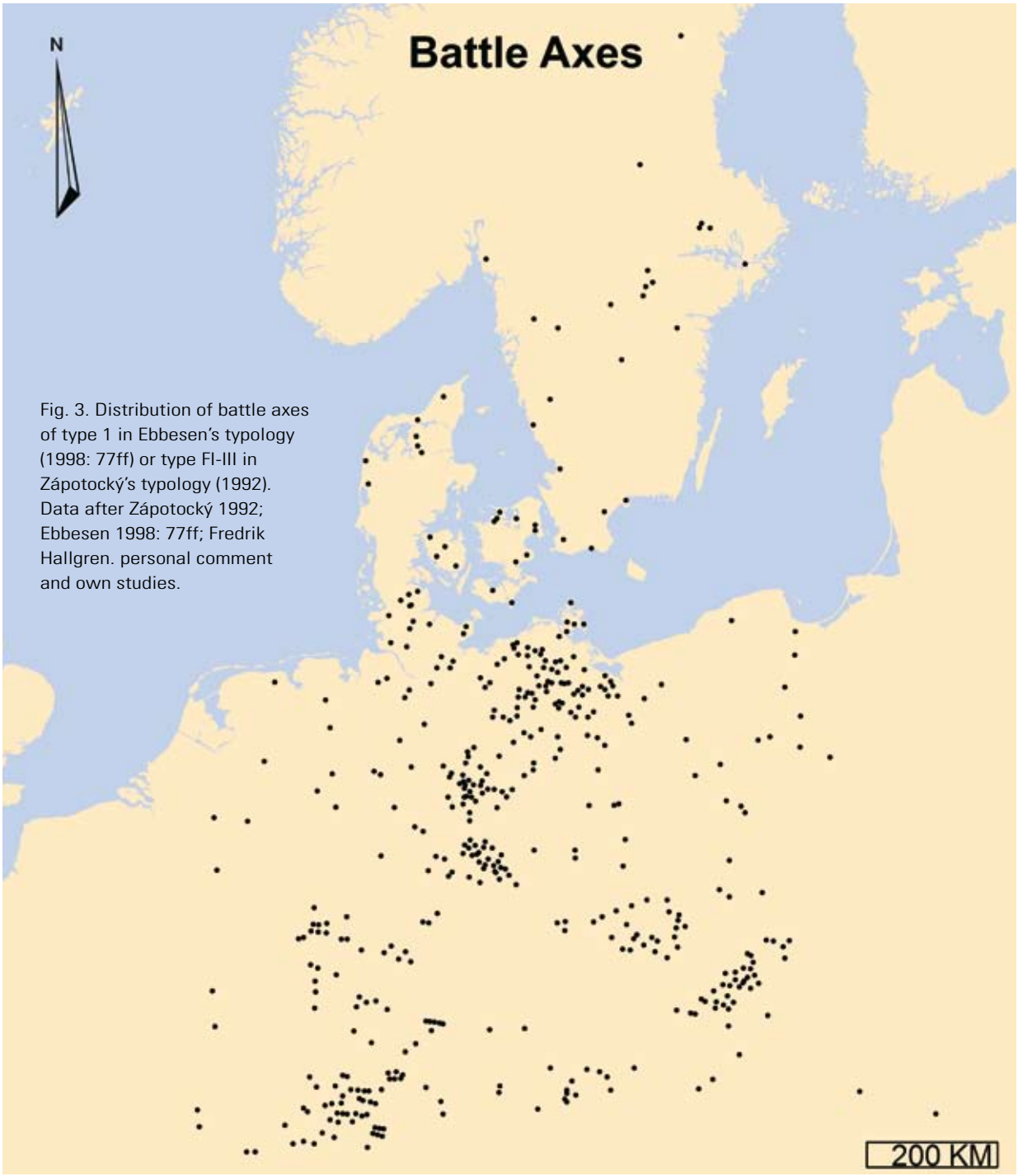


Fig. 3. Distribution of battle axes of type 1 in Ebbesen's typology (1998: 77ff) or type FI-III in Zápotocký's typology (1992). Data after Zápotocký 1992; Ebbesen 1998: 77ff; Fredrik Hallgren. personal comment and own studies.

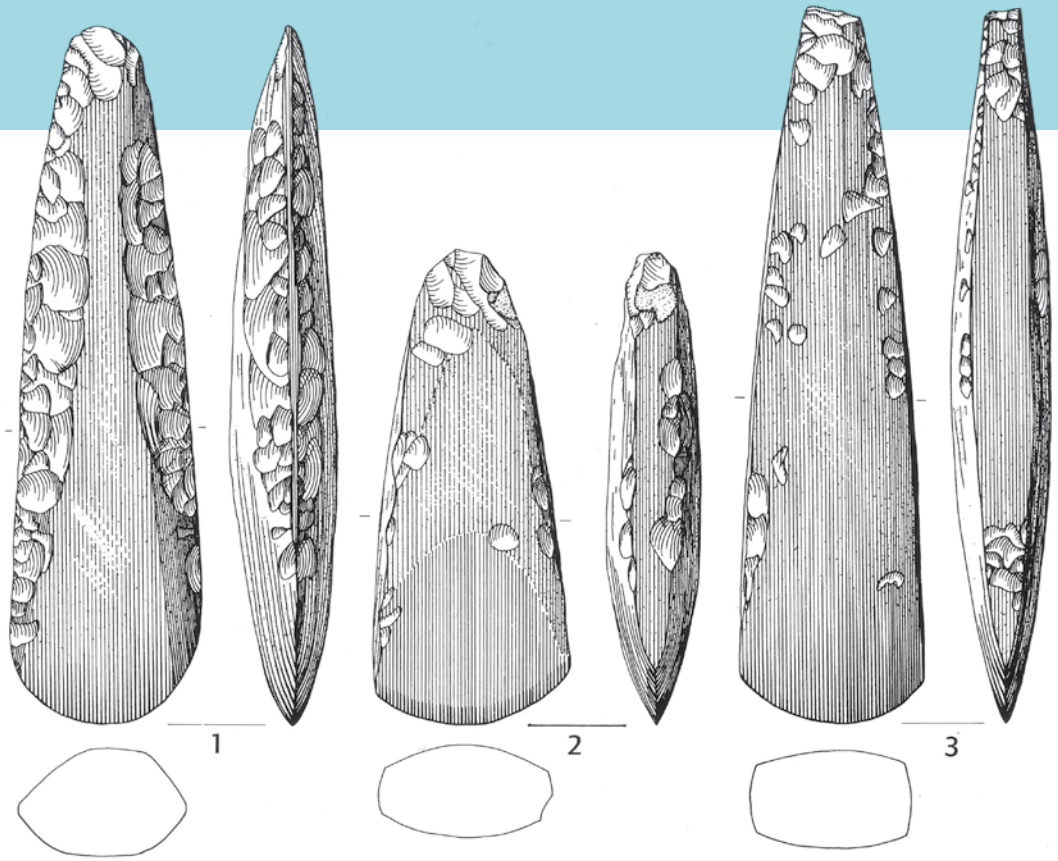


Fig. 4. Drawing of point-butted axes and their cross-section of type 1, 2 and 3. Type 1 has an oval cross-section. Type 2 has a three-sided cross-section. Type 3 has a four-sided cross-section. After: Petersen 1993.

type 1 in Ebbesen's typology (1998: 77ff) or type FI-III in Zápotocký's typology (1992), have been found in the Dragsholm burial. In this burial an antler pick was dated to (5090 ±65BP; 4036-3712 cal BC) (AAR-7418-2) and a human bone was dated to (5102±37; 3973-3797 cal BC) (AAR-7416-2), thus dating the earliest battle axes to the beginning of the fourth millenium BC (Brinch Petersen 2008: 33ff).

Particularly important too is the distribution pattern of polished point-butted axes of flint, which are associated with Early Neolithic sites with short-necked funnel beakers (fig. 4). Point-butted flint axes from ^{14}C-dated contexts and depositions demonstrate overlaps among the three types, but support the typology originally proposed by Nielsen (1977) (figs. 6, 7 & 8). The distribution of the point-butted axes indicates relatively dense inland habitation during the Early Neolithic (fig. 5). They seem to be concentrated in regions with light, easily arable soils. The point-butted and thin-butted flint axes from southern Norway (Hinsch 1955; Østmo 1988, 2007: 111ff) are probably related to the Early Neolithic agrarian expansion, whereas the point-butted axes from Trøndelag represent long-distance exchange networks with hunter-gatherer groups in the northern parts of Scandinavia (Valen 2012).

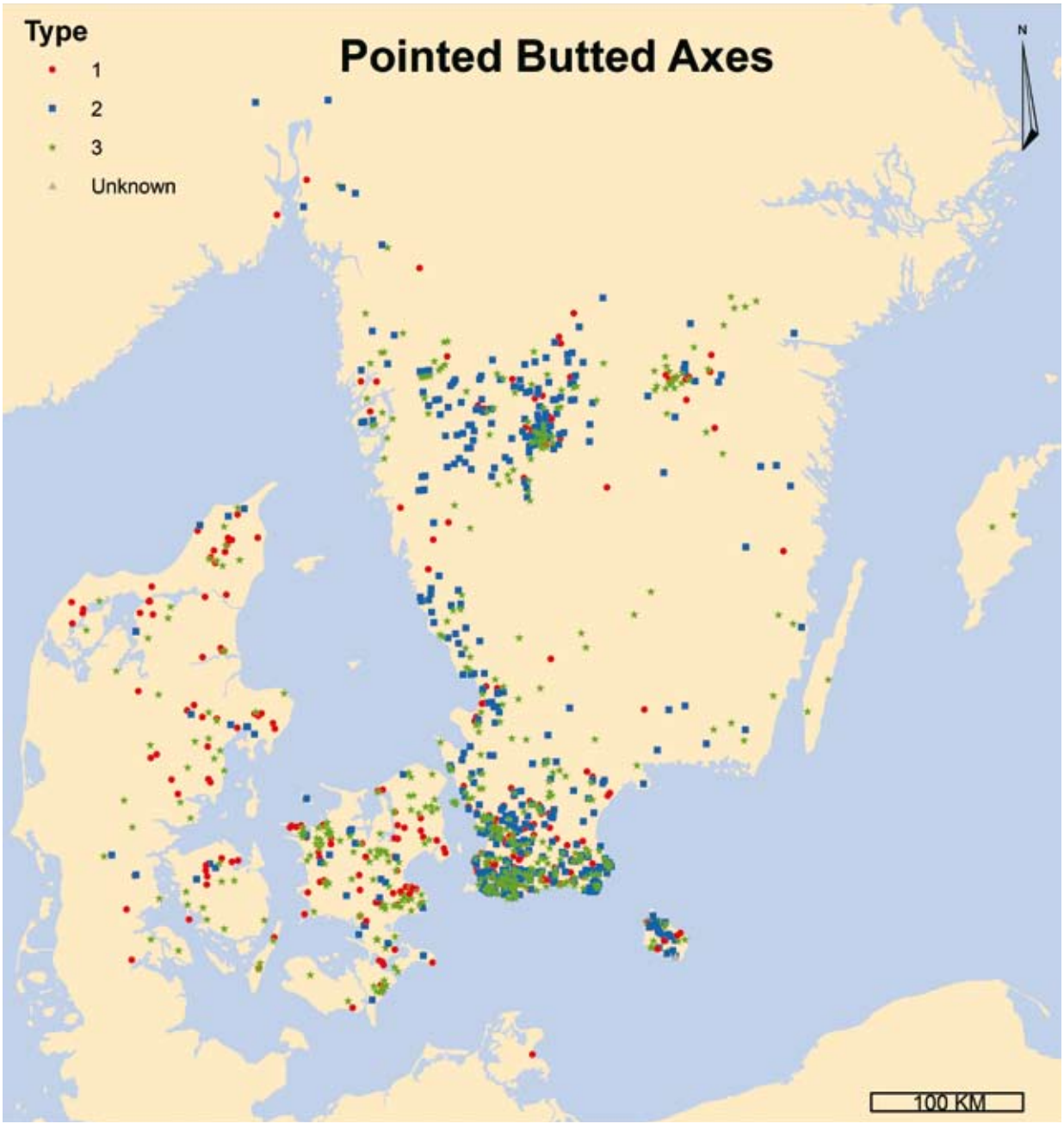


Fig. 5. Distribution of point-butted axes in Southern Scandinavia based on data from Denmark (Brøndsted 1938: 130ff), Scania (Hernek 1988: 216ff), Bohuslän, Dalsland, Halland and Vester Götland (Blomqvist 1990), Bornholm (Nielsen 2009: 16ff), central parts of Sweden (Hallgren 2008), Southern Norway (Østmo 1986: 190ff), central parts of Norway (Valen 2012) and own studies.

Depositions of pointed butted flint axes and their combination of types

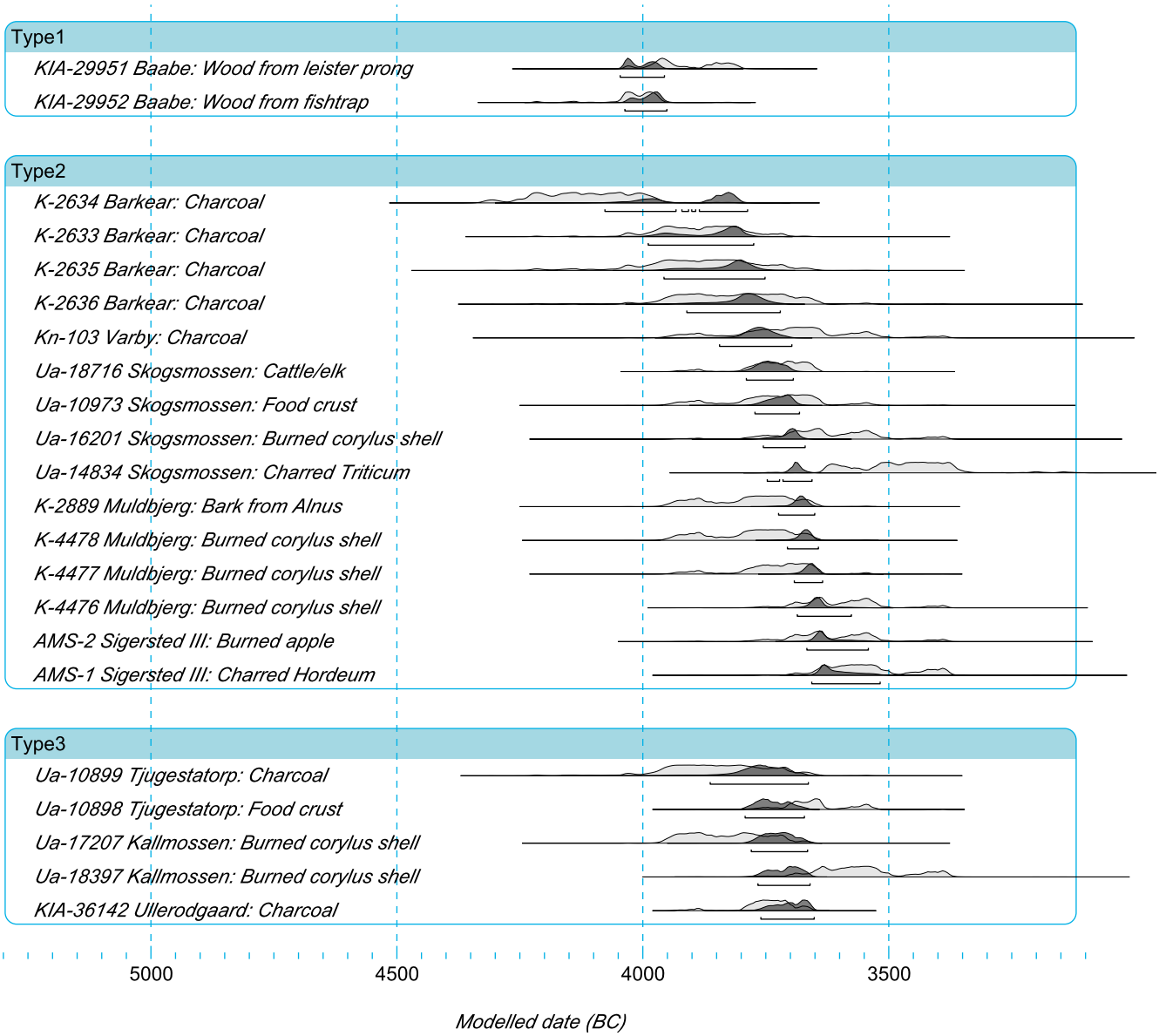
Site	Region	Nr. of axes	Polished or unpolished	1	2	3	Thin	Reference
Järavallen	Scania	11	unpolished	X				Rydbeck 1918, 9
Hammelen	Scania	2	unpolished	X				Rydbeck 1918, 9
Lackalänga	Scania	1+grinding stone	unpolished	X				Karsten 1994, 226
Svedala	Scania	1+grinding stone	polished	X				Rydbeck 1918, 9
Grönby	Scania	8	unpolished	X				Nielsen 1977, 121
Arrie	Scania	4	unpolished	X	X			Rydbeck 1918, 9ff
Ravnekær	Bornholm	5	polished and unpolished		X			P. O. Nielsen personal com.
Karaby	Scania	2	unpolished		X			Rydbeck 1918, 9
Dalby	Scania	2	polished		X			Rydbeck 1918, 12ff
Borgeby	Scania	2	polished		X			Rydbeck 1918, 12ff
V. Ågården	Vendsyssel	2	unpolished		X			Nielsen 1977, 121
Eslöv	Scania	2	unpolished		X			Nielsen 1977, 121
Fränninge	Scania	1+grinding stone	polished		X			Karsten 1994, 309
V. Ågården	Vendsyssel	3	unpolished		X	X		Nielsen 1977, 121
Li Markie nr. 7	Scania	3	unpolished		X	X		Rydbeck 1918, 11ff
Gualöv	Scania	3	polished		X	X	X	Karsten 1994, 348
Vanstad	Scania	2	polished			X		Rydbeck 1918, 16ff
Smeby Slöta	Västergötaland	5	polished			X		Nielsen 1977, 121
Ullerødgård	Zealand	3	polished			X	X	Rosenberg 2006
Kvistofta	Scania	3	polished			X	X	Karsten 1994, 215
Skegrie	Scania	2	unpolished			X	X	Karsten 1994, 294
Skurup	Scania	10	polished and unpolished			X	X	Karsten 1994, 303
Svedala	Scania	11	polished and unpolished			X	X	Karsten 1994, 274
Södra Åsum	Scania	2	polished			X	X	Karsten 1994, 310
Fjälkinge	Scania	2	polished and unpolished			X	X	Karsten 1994, 343
Kverrestad	Scania	3	polished			X	X	Karsten 1994, 328
Öster Sönnarslöv	Scania	2	unpolished			X	X	Karsten 1994, 347
Hörby	Scania	6	polished			X	X	Karsten 1994, 238
Bodarp	Scania	6	unpolished			X	X	Karsten 1994, 282

Fig. 6. Table showing the depositions of point-butted flint axes and their type combinations.

Evidence of agrarian activity is first observed from the Middle and Late Neolithic in the western and central parts of Norway. The Middle Neolithic battle axes found in these areas have parallels in the Battle Axe Culture, thus indicating communication between western and eastern Norway and the western part of Sweden (Olsen 2009: 587). Lines of communication went not only east and west but also south and north, since a huge number of flint daggers from southern Scandinavia have been found along the coast of Norway (Apel 2001). There must have been huge, systematic production and distribution of axes, and later of daggers and sickles, from these flint mines in southern Scandinavia. This is revealed

Fig. 7. ^{14}C dates of Early Neolithic sites or contexts containing point-butted axes.

All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.



C-14 dates of Early Neolithic sites and contexts with pointed butted axes

Site	Type	BP	±	Lab nr.	Material	References
Baabe	1	5134	44	KIA-29951	Wood from leister prong	Hirsch et al. 2007, 25ff
Baabe	1	5203	36	KIA-29952	Wood from fishtrap	Hirsch et al. 2007, 25ff
Barkær	2	5270	75	K-2634	Charcoal	Liversage 1992, 59
Barkær	2	5100	75	K-2633	Charcoal	Liversage 1992, 59
Barkær	2	5090	100	K-2635	Charcoal	Liversage 1992, 59
Barkær	2	5010	100	K-2636	Charcoal	Liversage 1992, 59
Värby	2	4900	100	Kn-103	Charcoal	Salomonsson 1970, 72
Skogsmossen	2	4940	50	Ua-18716	Cattle/elk	Hallgren 2008, 233ff
Skogsmossen	2	4930	80	Ua-10973	Food crust	Hallgren 2008, 233ff
Skogsmossen	2	4850	80	Ua-16201	Hazel-nut	Hallgren 2008, 233ff
Skogsmossen	2	4680	70	Ua-14834	Charred Triticum	Hallgren 2008, 233ff
Muldbjerg	2	4980	70	K-2889	Bark from Alnus	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4940	65	K-4478	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4930	65	K-4477	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Muldbjerg	2	4830	65	K-4476	Burned hazelnutshell	Troels-Smith 1957, 1ff; Stafford 1999, 91
Sigersted III	2	4840	70	AMS-2	Charred apple	Koch 1998
Sigersted III	2	4780	70	AMS-1	Charred barley	Koch 1998
Tjugestatorp	3	5050	90	Ua-10899	Charcoal	Hallgren 2008, 233ff
Tjugestatorp	3	4865	55	Ua-10898	Food crust	Hallgren 2008, 233ff
Kallmossen	3	5025	60	Ua-17207	Hazel-nut shell	Hallgren 2008, 233ff
Kallmossen	3	4795	75	Ua-18397	Hazel-nut shell	Hallgren 2008, 233ff
Ullerødgård	3	4965	35	KIA-36142	Charcoal	Esben Aasleff personal comment

Fig. 8. Table of ^{14}C dates from Early Neolithic sites or contexts containing point-butted axes in southern Scandinavia.

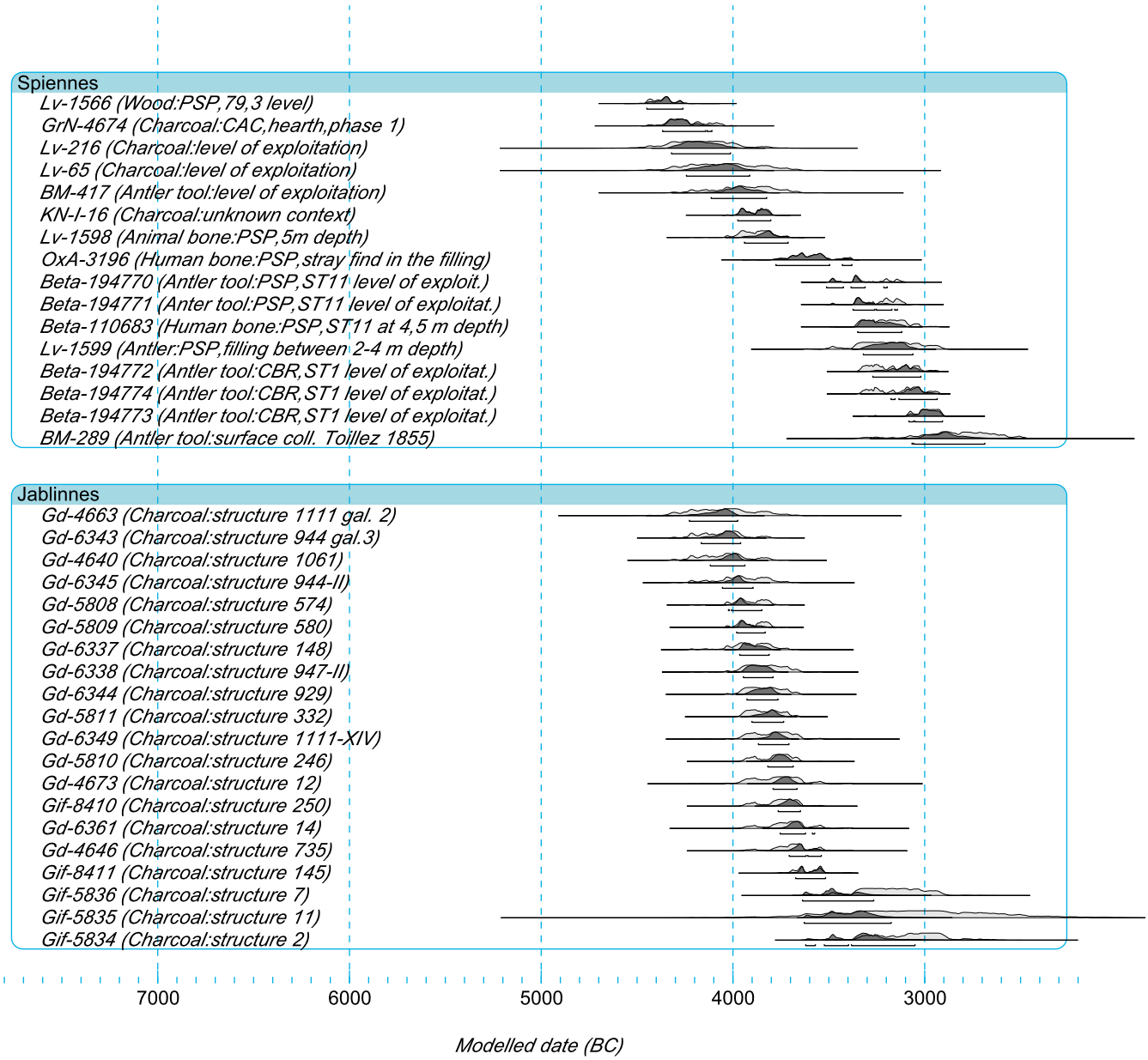
by clear concentrations of Neolithic axes, daggers and sickles near the flint mines in northern Jutland (Hov, Bjerre and Skovbakken), eastern Zealand (Stevns, now eroded by the sea) and Scania (Södra Sallerup) (Becker, 1980: 456ff; Olausson et al. 1980: 183; Sarauw 2007; Bech & Mikkelsen 1999: 65ff; Eriksen 2010: 81ff).

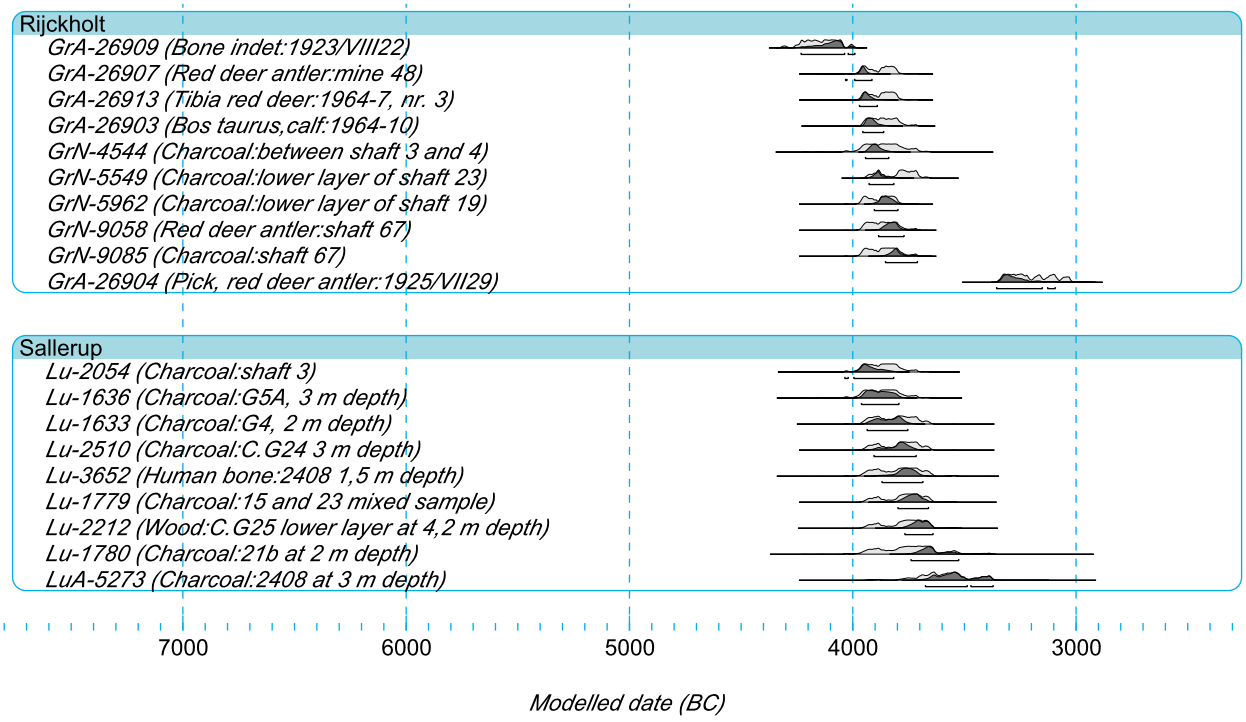
Flint mining

Deep mining for flint is a characteristic feature of the central European Michelsberg Culture (4400-3500 BC) (Lüning 1968). The mines at Spiennes in southern Belgium, Rickholt in the Netherlands and Jablines/Le Haute Château in northern France all begin their activities between 4400 and 4200 BC (Bostyn & Lanchon 1992; Collet et al. 2004: 151ff; Grooth et al. 2011: 77ff) (fig. 9). Preforms of point-butted axes found in all these mines prove that we are dealing with systematic production. The earliest evidence of mining in southern Scandinavia is docu-

Fig. 9. ^{14}C dates of Early Neolithic flintmines.

Flint mines at Spiennes in southern Belgium, Rickholt in the Netherlands, Jablines/Le Haute Château in Northern France and Södra Sallerup in Scania. Based on data from Bostyn & Lanchon 1992; Collet et al. 2004: 151ff; Grooth et al. 2011: 77ff; Olausson et al. 1980: 183; Elisabeth Rydebeck. personal comment. All radiocarbon dates have been calibrated using the OxCal v4.1.7 program.





mented at Södra Sallerup, which has been dated to 4000 cal BC (Olausson et al. 1980: 183). The practice of mining flint probably came together with these central European pioneering farmers. Many of the mines continued in use producing flint daggers and sickles in the Late Neolithic and Bronze Age.

Reasons for the different expansions in Scandinavia

The reasons for the different expansions in Scandinavia are still unclear. One of the reasons for the expansion during the Early Neolithic to southern Scandinavia could be the relatively easy access to some of the best flint resources in northern Europe. Clearly good flint resources did not play a role during the later expansions farther north. Another possible explanation could be growing population pressure combined with the fact that cultivation by the slash-and-burn method requires much space. These factors could have forced pioneering farmers during the Neolithic and Bronze Age to cultivate new lands farther north, thus pushing agriculture farther north. The various stagnations and declines might be explained by reactions against the agrarian way of life or variations in the climate conditions. The ability of grains to

grow in colder environments with short summers, together with positive climatic conditions for early agriculture, might be very important reasons for sudden expansions or stagnations. An example of stagnation and decline has been interpreted for the Pitted Ware Culture (3200-2300 BC). Instead of a consolidation phase in agrarian society during the Middle Neolithic, a return to a hunter-gatherer way of life along the east and west coasts of Sweden is evident. The classical Pitted Ware sites from Gotland illustrate specialized hunter-gatherer subsistence. However, there are also examples of Pitted Ware sites with a mixed economy consisting of agriculture with some hunting and fishing (Larsson 1992: 91ff, 2004: 61ff; Burenhult 1997).

Many of the expansions in Scandinavia could have consisted of small groups of pioneering farmers. Recently Rowley-Conwy (2011) has suggested that pioneering farmers expanded to the north in a process of leap-frogging, punctuated or sporadic immigration. A similar model has been presented by Zilhao (2001: 14180ff) to explain rapid Neolithic expansion in the Mediterranean. The expansion towards Scandinavia happened so fast during the Early Neolithic that boats must have been used, as indicated by very early Neolithic agrarian habitations on islands like Bornholm and Gotland (Lindqvist & Possnert 1997: 73f; Casati & Sørensen 2006: 39; Nielsen 2009: 9ff). Boats were probably also involved in the later expansions during the Neolithic and Bronze Age demonstrated by the distribution of thin-butted axes, battle axes, flint daggers and bronze artefacts along the western coast of Norway (Hinsch 1955; Apel 2001: 282; Asprem 2012; Valen 2012; Rønne 2011: 58ff).

Cultural dualism

Discussion of whether agriculture was introduced by migrating farmers or local hunter-gatherers during the Neolithic and Bronze Age still characterizes the debate in Scandinavia. During the Neolithic an agrarian way of life was practised on inland sites at the same time as hunting and fishing at sites near the coast, fjords or the larger inland lakes. Are we dealing with 'commuting' farmers or cultural dualism? If hunter-gatherers embarked on the venture of keeping domesticated animals all year round, they would have had to collect huge amounts of food for the winter months. In order to get enough food it would be necessary to cultivate larger fields of grain and grass so that sufficient straw and hay could be dried for the winter. This would require long-term skill in agrarian technologies to succeed. If these hunter-gatherers were to succeed as farmers, they would gradually need to integrate with agrarian societies. In particular, the use of slash-and-burn technique to clear the forest

for cultivation required planning several years ahead. Several experiments have shown that after two to three years of cultivation the nutrients in the soil were used up, with the consequence that the yield would fall drastically (Lünning 2000: 174; Ehrmann et al. 2009: 44ff; Schier 2009: 15ff). After this the field could be used as a grazing area for domesticated animals. But in order to continue cultivation it was necessary to start all over in another area, thus proving that this method requires access to huge areas. Recently, Kind (2010: 457) has proposed that the transition towards agriculture is determined by intensified social interaction between local hunter-gatherers and pioneering farmers, who are characterized as the "managers of neolithisation".

Cultural dualism could be indicated by evidence of actual cultivation found at a hunter-gatherer site. The Early Neolithic Bjørnsholm kitchen midden could be one such site, because pollen of barley *(Hordeum)* and wheat *(Triticum)* was found beneath the neighbouring long dolmen (Andersen & Johansen 1992: 38ff; Andersen 1993: 59ff). Visborg could be another example, because a burned layer beneath the kitchen midden indicates use of the slash-and-burn method (Andersen 2008: 69ff). A different case of cultural dualism could be the Early Neolithic Dragsholm man, who was buried in a kitchen midden and equipped as a warrior. He might have been a typical "manager of neolithisation" (Brinch Petersen 2008: 33ff). Cultural dualism has also been proposed between the Pitted Ware Culture (hunter-gatherers) and Battle Axe Culture (farmers). The early battle axe types within the Battle Axe Culture were concentrated at inland sites and are rarely found at the coastal Pitted Ware sites. This indicates two separate material cultures and thus cultural dualism. Later battle axe types, however, have been found at coastal sites, and this documents a gradual assimilation of Pitted Ware people into the Battle Axe tradition (Larsson 1992: 146ff; Iversen 2010: 32).

In Norway the process of cultural dualism might be indicated when a rapid transition to agriculture is evident. During the Early Neolithic in southeastern Norway, there is very little primary evidence of cultivation, which could indicate that agriculture only played a minor role in Early Neolithic subsistence (Prescott 1996: 77ff, 2009: 193ff). Recently Glørstad has interpreted the Early Neolithic in southeastern Norway as an expansion of big game hunting, not of agriculture (Glørstad 2010: 287). However, the sudden appearance of megaliths, polygonal battle axes and point-butted and thin-butted axes together with pollen from cereals could be interpreted as

pioneering farmers entering this area from southern Scandinavia (Østmo 1988). However, more investigation of this region is needed in the future. A rapid transition towards agriculture is also documented in western Norway during the Middle Neolithic by direct ^{14}C datings of cultivation layers. Whether agriculture was introduced by migrating farmers or local hunter-gatherers is still an open question (Hjelle et al. 2006: 147ff). If migrating farmers had arrived in large numbers, we should be able to find changes in material culture corresponding to those in the source areas. However, no such evidence has been found. A possible scenario could involve small groups of pioneering farmers entering western Norway by boat from southeastern Norway or western parts of Sweden at places with easily cultivable land (Olsen 2009: 590ff; Østmo 2010: 44ff). An expansion farther north along the western coast of Norway may be associated with the wide distribution of flint daggers during the Late Neolithic, and of bronze artefacts during the Bronze Age (Prescott 1996: 85; Apel 2001; Rønne 2011; Kaul 2011) (fig. 10). Currently it is difficult to conclude whether agriculture was brought to the middle and northern parts of Norway by migrating farmers or local hunter-gatherers. Future studies should concentrate on finds from sites located on easily cultivable land in Norway in order to gain new knowledge from these agrarian settlements. Many of these sites are located near the sea. It is probable that farming in Norway also involved more exploitation of marine resources than in other regions in Scandinavia.

Another way of documenting cultural dualism is by conducting DNA analyses. The burial site at Ostorf in northern Germany was originally interpreted as a hunter-gatherer enclave surrounded by agrarian societies, because the individuals showed a high intake of marine resources (Lübke et al. 2009; Shulting 2011: 21). However, three burials contained Palaeolithic/Mesolithic haplogroups U5 and U5a, while four other burials contained Neolithic haplogroups J, K and T2e (Bramanti et al. 2009: 139). The individuals at Ostorf are a rare example of hunter-gatherers and possible farmers who may have integrated with each other. Moreover, recent studies have shown that Palaeolithic/ Mesolithic haplogroup U (U4 and U5) exists among Neolithic individuals and Bronze Age populations in southern Scandinavia (Melchior et al. 2010: 6ff). This result therefore does not support a massive migration of Neolithic populations into Scandinavia. Arguably, it must be noted, the Neolithic material lacks precise dating, since it comes from a passage grave where there may have been reburials. All the preliminary DNA results from these analyses suggest a possible scenario with a small migration

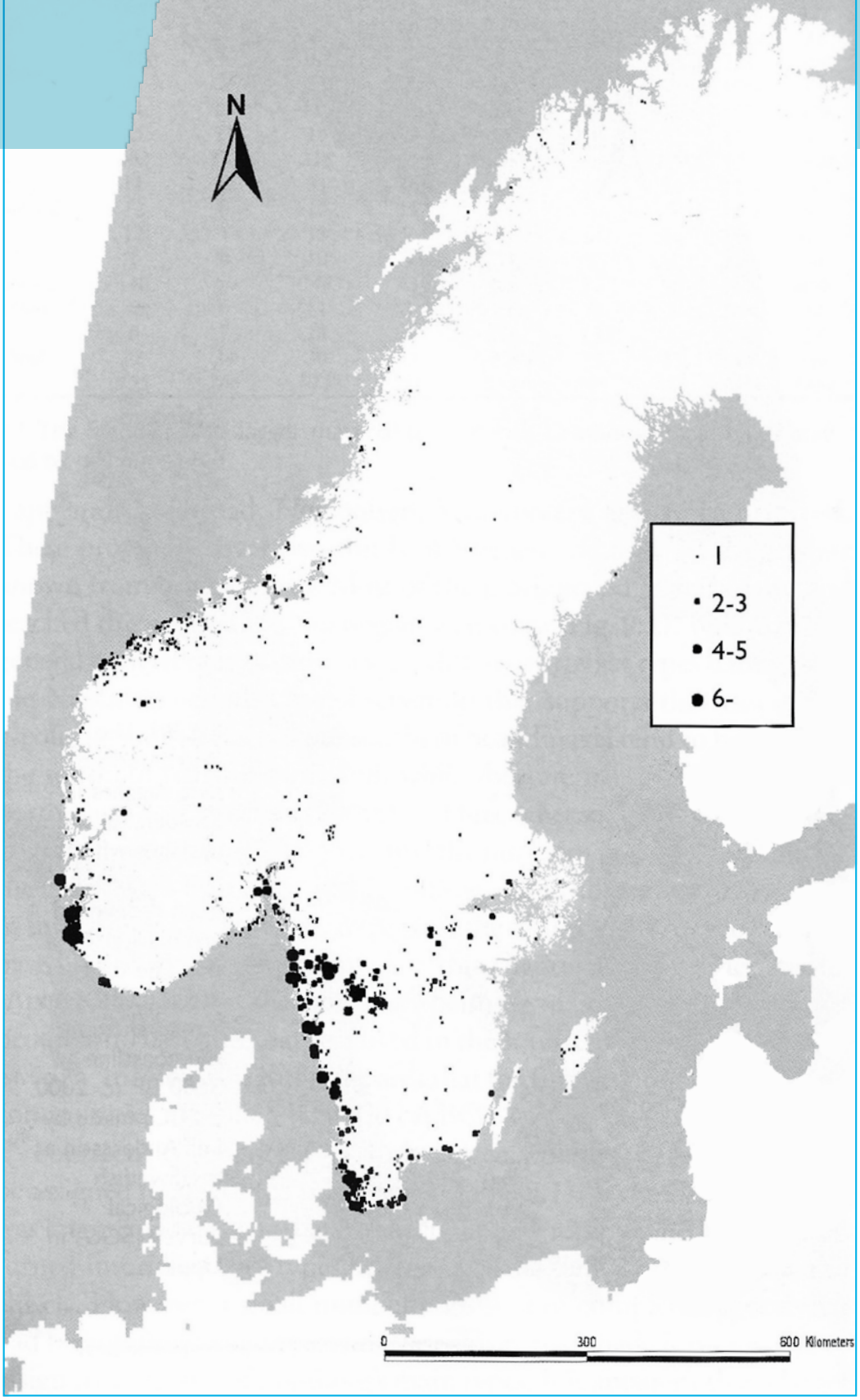


Fig. 10.
The distribution of type 1 flint daggers in Sweden and Norway. After Apel 2001: 282.

Fig. 11. ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle.

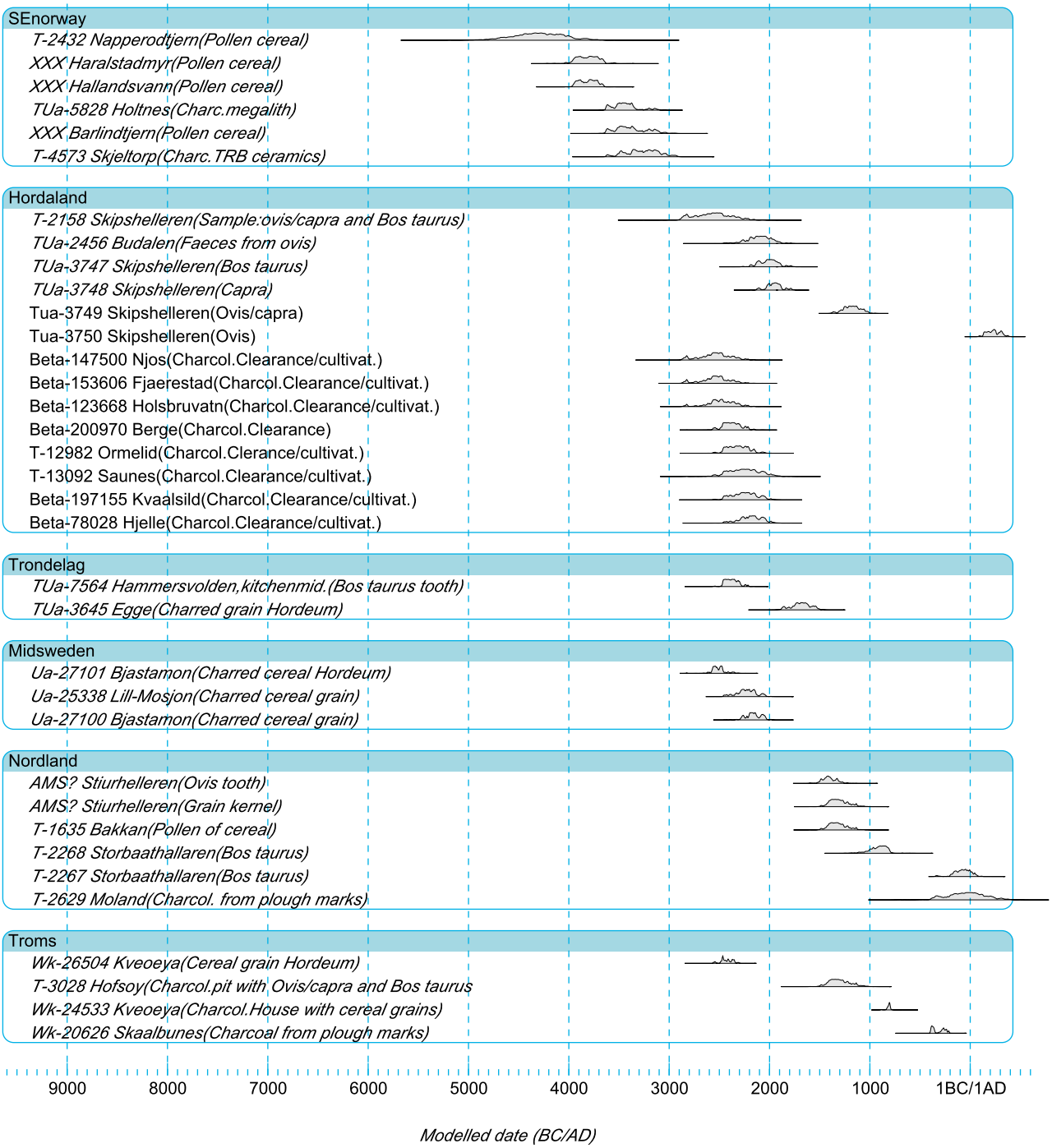


Table of ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle

Xx	Xx	Xx	Lab no.	BP		References
Vestfold	Napperødtjern	Pollen of cereal	T-2432	5460	230	Henningsmoen 1980, 175
Østfold	Haralstadmyr	Pollen of cereal	XXX	5010	100	Østmo 1988
Vest-Agder	Hallandsvann	Pollen of cereal	XXX	5010	70	Prøsch-Danielsen 1996
Østfold	Holtnes	Context:Charcoal from megalith	TUa-5828	4660	80	Østmo 1985
Aust-Agder	Barlindtjern	Pollen of cereal	XXX	4630	100	Høeg 1982
Østfold	Skjeltorp megalith	Context:Charcoal near small funnel beaker	T-4573	4560	100	Østmo 1985
Hordaland	Skipshelleren	Sample date of bone fragm. Of ovis/capra and Bos taurus	T-2158	4020	120	Olsen 1976
Hordaland	Budalen 17	Faeces from a sheep	TUa-2456	3700	80	Nærøy 1994, 152
Hordaland	Skipshelleren	Bos taurus	TUa-3747	3635	65	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Capra	TUa-3748	3595	50	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Ovis/capra	Tua-3749	2955	50	Hjelle et al. 2006, 157
Hordaland	Skipshelleren	Ovis	Tua-3750	1790	45	Hjelle et al. 2006, 157
Hordaland	Njøs	Clearance/cultivation	Beta-147500	4000	90	Johannesen & Hjelle 2001
Hordaland	Fjærestad	Clearance/cultivation	Beta-153606	4000	80	Diinhoff 2004
Hordaland	Holsbruvatn	Clearance/cultivation	Beta-123668	3970	80	Lødøen & Hjelle 1999
Hordaland	Berge	Clearance	Beta-200970	3900	60	Melle & Simpson 2005
Hordaland	Ormelid	Clearance/cultivation	T-12982	3850	70	Bade et al. 2002
Hordaland	Saunes	Clearance	T-13092	3805	110	Pilskog 1997
Hordaland	Kvålsild	Clearance/cultivation	Beta-197155	3800	80	Slinning & Hjelle 2004
Hordaland	Hjelle	Clearance/cultivation	Beta-78028	3760	70	Gundersen & Soltvedt 1995
Trøndelag	Hammersvolden, kitchenm.	Cattle tooth	TUa-7564	3895	40	Asprem 2012
Trøndelag	Egge	Charred grain Hordeum	TUa-3645	3385	70	Solem 2002, 6
Västernordland	Bjästamon	Charred cereal grain A983	Ua-27101	3985	45	Gustafsson & Spång 2007, 80
Västernordland	Lill-Mosjön	Charred cereal grain, Hordeum from pit 24	Ua-25338	3790	55	Färjare & Olsson 2000, 32
Västernordland	Bjästamon	Charred cereal grain from A983.S4	Ua-27100	3750	45	Gustafsson & Spång 2007, 80
Nordland	Stiurhelleren	Ovis tooth	AMS?	3135	60	Johansen 1990, 5
Nordland	Stiurhelleren	Grain kernel 1	AMS?	3060	70	Johansen 1990, 5
Nordland	Bakkan	Pollen of cereals	T-1635	3070	70	Johansen & Vorren 1986, 740
Nordland	Storbåthallaren	Bos taurus	T-2268	2740	80	Johansen & Vorren 1986, 742
Nordland	Storbåthallaren	Bos taurus	T-2267	2050	60	Johansen & Vorren 1986, 742
Nordland	Moland	Context:charcoal from plow marks	T-2629	2010	150	Johansen & Vorren 1986, 742
Troms	Kveøya	Cereal grain of barley	Wk-26504	3936	30	Johansen 1990
Troms	Høfsøy	Context:charcoal from pit containing Ovis/capra and Bos taurus	T-3028	3060	80	Johansen & Vorren 1986, 745
Troms	Kveøya	Postholes to a house, charcoal, cereal grains	Wk-24533	2642	30	Arntzen & Sommerseth 2010
Troms	Skålbunes	Plough mark:charcoal	Wk-20626	2273	35	Arntzen 2012

Fig. 12. Table of ^{14}C dates showing the agrarian expansion towards and beyond the Arctic Circle.

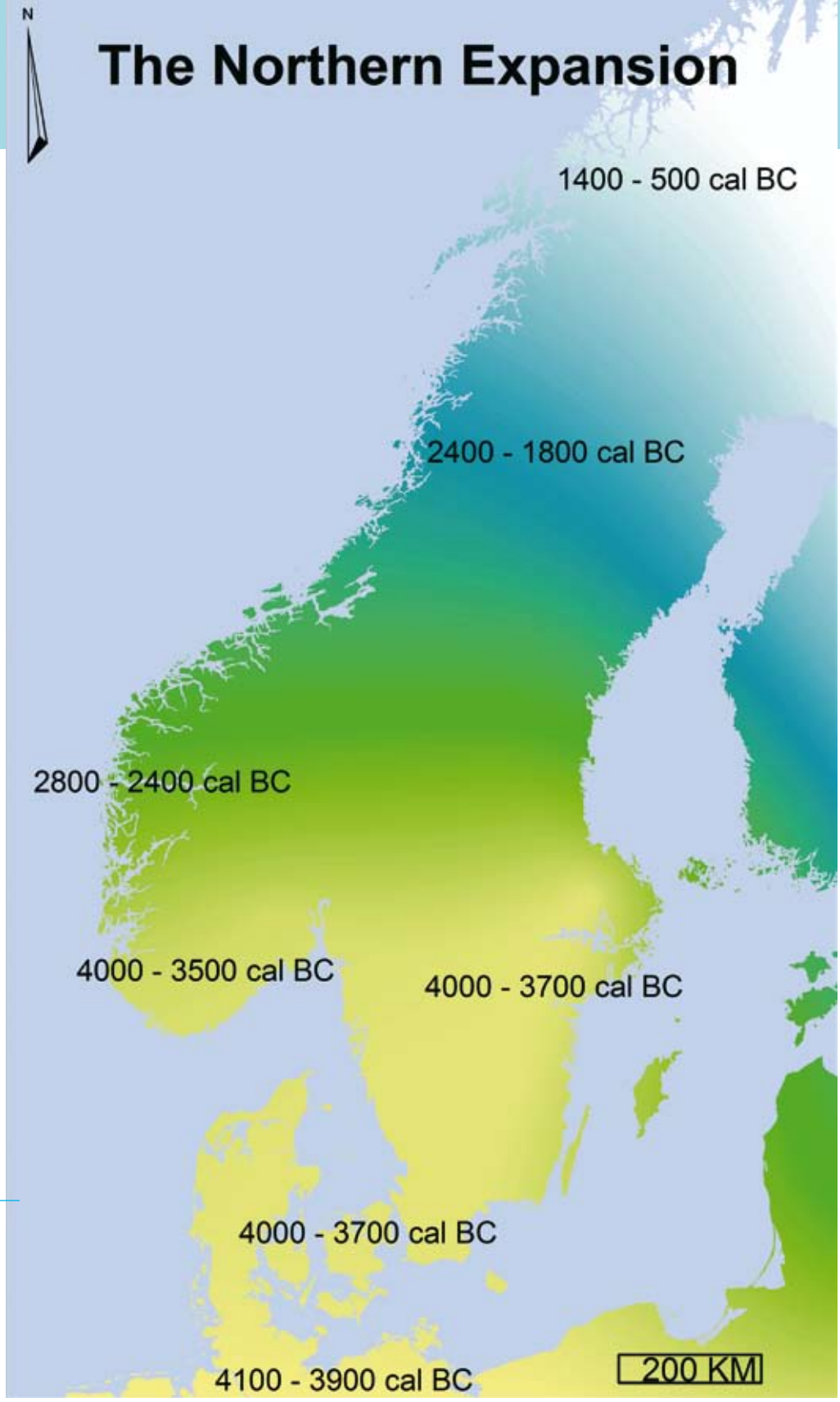
of pioneering farmers in many regions. After a while, the agrarian technology could have been adopted by surrounding hunter-gatherers, who in many regions of Scandinavia could have been superior in numbers to the pioneering farmers. This model argues for a cultural dualism involving a mixture of pioneering farmers and the integration of local hunter-gatherers who adopted an agrarian lifestyle.

Future research areas

Generally the hypothesis of cultural dualism can be proved or disproved by C-14 dating, stable isotope and DNA analysis. However, if the DNA influx from Neolithic pioneering farmers consists of Palaeolithic/Mesolithic haplogroups (D and U4 and U5) representing hunter-gatherers who became farmers, it will be difficult to detect any differences (Bramanti et al. 2009: 137ff). Stable isotope analysis has already been conducted in Denmark by Tauber (1981) and Fischer et al. (2007: 2125ff). Currently marine values of $\delta^{13}C$ and $\delta^{15}N$ have all been extracted from Mesolithic hunter-gatherers, while most of the Early Neolithic samples, except one from Sejrø, showing non-marine values. It is clear that human bones from the Early Neolithic coastal kitchen-midden sites are absent from these finds. The abrupt shift in $\delta^{13}C$ values in Early Neolithic skeletons in Denmark could be interpreted as a deliberate deselection of marine food as a resource (Andersen et al. 1986; Brinch Petersen & Egeberg 2009: 563; Milner et al. 2004: 9ff). However, this does not necessarily mean that farmers moved away from the coastal areas, as Funnel Beaker hunting stations are documented through the Early and Middle Neolithic (Skaarup 1972). But it could reflect a possible gradual decline in the use of marine resources.

Stable isotope analyses from Öland demonstrate a marked dietary shift during the second half of the third millennium, from a mixed marine diet to the use of exclusively terrestrial resources (Eriksson et al. 2008: 520ff). The result has been interpreted as the onset of the large-scale introduction of farming on Öland. Large-scale farming took place at the end of the Neolithic, not at the beginning. However, it is important to acknowledge that we are dealing here with an island in the Baltic Sea where it is only natural to exploit marine resources. The result therefore does not apply to the rest of southern Scandinavia, as proven by the results presented by Tauber (1981), but it demonstrates that local variations can be observed in the diet.

Fig. 13. Map showing a preliminary interpretation of the agrarian expansion in Scandinavia during the Neolithic and Bronze Age. Northern Germany (4100-3900 BC), southern Scandinavia, western and southern Sweden (4000-3700 BC), southeastern Norway (4000-3500 BC), western Norway (2800-2400 BC), central Norway and Sweden (2400-1800 BC) and northern Norway (1400-500 BC).


N
The Northern Expansion
1400 - 500 cal BC
2400 - 1800 cal BC
2800 - 2400 cal BC
4000 - 3500 cal BC
4000 - 3700 cal BC
4000 - 3700 cal BC
4100 - 3900 cal BC
200 KM

Concluding remarks

The agrarian expansion during the Early Neolithic in southern Scandinavia was a rapid process lasting only a few centuries between 4000 and 3700 BC. The speed of the expansion was fast and involved small groups of migrating pioneering farmers, possibly using boats as a means of transport. They originated from Middle Neolithic societies in central Europe. The reason for the expansion is still unclear, but growing population pressure combined with the fact that cultivation with the slash-and-burn method requires much space might have forced some pioneering farmers to move north. They brought with them a complete agrarian technology, structures, new material culture and ideology. The question of what happened to the local hunter-gatherers is still open to discussion. Either they became farmers within one or two generations, which could explain the settling of both inland and coastal sites where they could both exploit agrarian resources and engage in hunting and fishing activities; or we could be dealing with a cultural dualism consisting of pioneering farmers at inland-oriented sites and hunter-gatherers at coastal sites. Cultural dualism could be an interpretation when evidence of cultivation has been found at a hunter-gatherer site. Both explanations are possible, but currently the archaeological record in southern Scandinavia tends to favour cultural dualism during the earliest part of the Early Neolithic. The earliest expansion in south-eastern Norway occurs during the Early Neolithic (4000-3500 BC).

However, the evidence is rather limited and the importance of agriculture may have been rather low, and this contrasts with the sudden appearance of a different material culture. The material culture indicates that we could be dealing with small groups of pioneering farmers originating in southern Scandinavia. However, more investigations in this region are needed in the future. The next advance is observed in the western part of Norway during the Middle Neolithic (2800-2400 BC). The expansion could also have involved small groups of pioneering farmers entering western Norway by boat from southeastern Norway or western parts of Sweden, because thick-butted stone axes and battle axes come from these regions. The advance continued during the Late Neolithic (2400-1800 BC) to central parts of Scandinavia and towards northern Scandinavia and beyond the Arctic Circle during the Middle and Late Bronze Age (1400-500 BC). It is difficult to conclude whether agriculture was brought to the middle and northern parts of Scandinavia by migrating farmers or local hunter-gatherers. Future studies should concentrate on finds from sites located on easily cultivable land in Norway and Sweden in order to gain new knowledge from these agrarian settlements (fig. 13). Generally

the transition towards a Neolithic way of life in Scandinavia can be interpreted as a complex and continuous process of migration, integration and gradual assimilation between neighbouring farmers and hunter-gatherers, taking place at different rates from region to region depending on environmental as well as ideological factors.

Note 1.
We have to acknowledge that there are problems in using ^{14}C dates, since some 'wiggles', especially within the Early Neolithic, have been observed on the calibration curve (Litt et al. 2001).

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Challenges and solutions

Back cover illustration:
View of modern sheep farm and hayfields in the central Vatnahverfi region, South Greenland.
Photo: Christian Koch Madsen.

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